

# **Real Time System**

## **Third Level**

### **Lecture Eleven**

# **Interfacing Circuit using The 8155 Programmable Device**

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RealTime Systems.  
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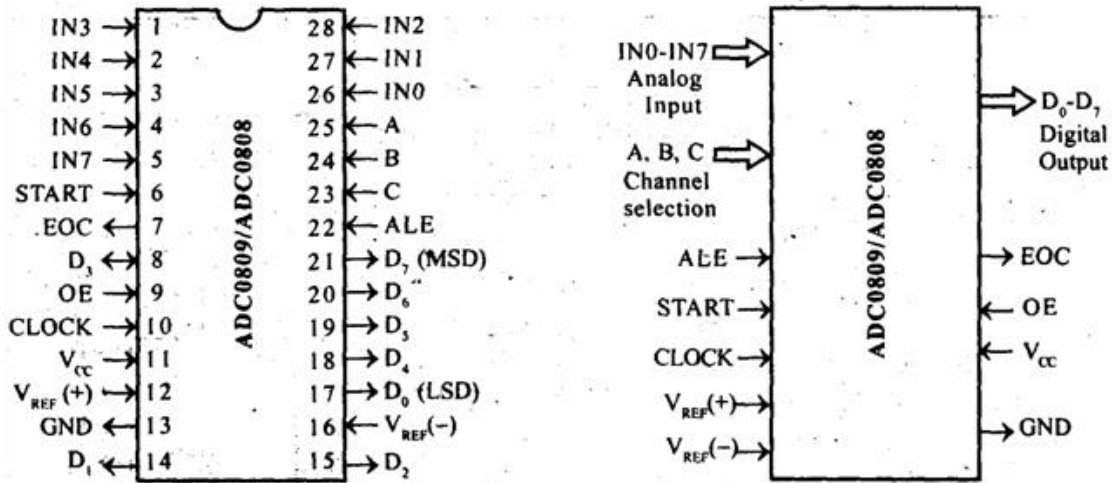
#### Goals

Up-on completing this lecture, the student should be able to:

- 1- Utilize 8155 in more complex designs.
- 2- Write the pseudo-code for the interfacing cct.

Cont. to 8155:

Interfacing Design for 8155 (examples):



LSD = Least Significant Digit, MSD = Most Significant Digit

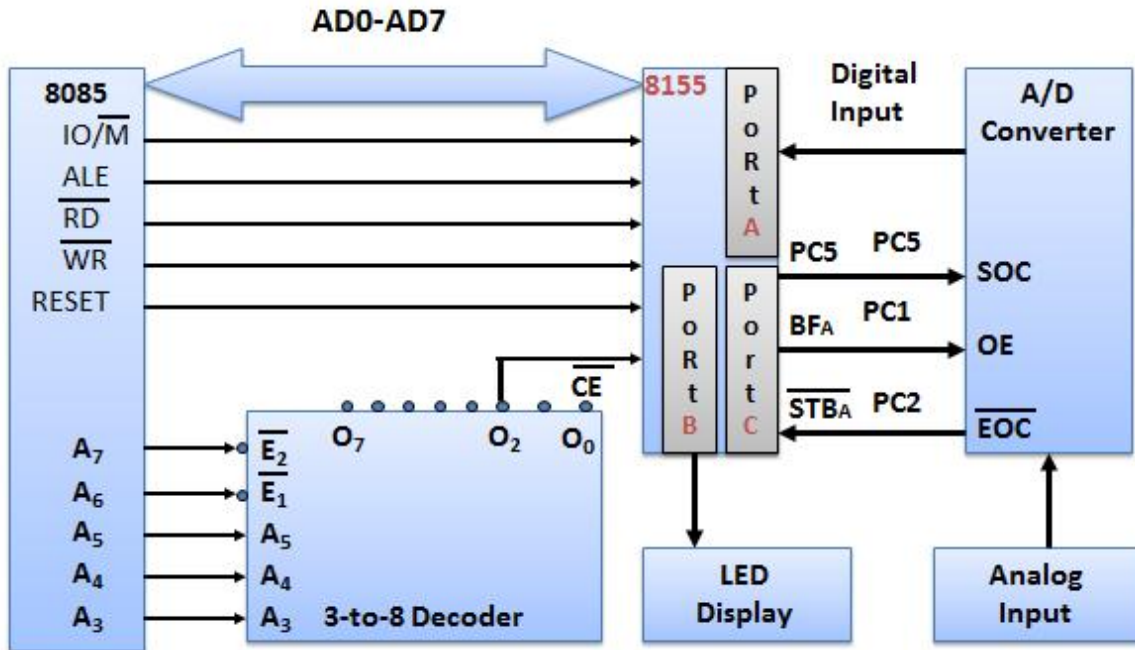
Signals	Description
IN0-IN7	Eight single ended analog input to ADC.
A, B, C	3-bit binary input to select one of the eight analog signals for conversion at any one time.
ALE	Address latch enable. Used to latch the 3-bit address input to an internal latch.
START	Start of conversion pulse input. To start ADC process this signal should be asserted <b>high</b> and then <b>low</b> . This signal should remain <b>high</b> for atleast 100ns.
CLOCK	Clock input and the frequency of clock can be in the range of 10 kHz to 1280 kHz. Typical clock input is 640 kHz.
$V_{REF}(+), V_{REF}(-)$	Reference voltage input. The positive reference voltage can be less than or equal to $V_{cc}$ and the negative reference voltage can be greater than or equal to ground.
$D_0-D_7$	The 8-bit digital output. The reference voltages will decide the mapping of analog input to digital data.
EOC	End of conversion. This signal is asserted <b>high</b> by the ADC to indicate the end of conversion process and it can be used as interrupt signal to processor.
OE	Output buffer Enable. This signal is used to read the digital data from output buffer after a valid EOC.
$V_{cc}$	Power supply, +5V
GND	Power supply ground, 0V

Ex 1: Design (draw and explain) an interfacing circuit using the 8155 to read and display data from an A/D converter to meet the following requirement:-

- Setup port A in the handshake mode to read data from A/D converter.

- Setup port B as O/P port to display data at seven segment LED.
- Use a 3 to 8 decoder to assign I/O port address (O2).
- Use line PC2, 1 for EOC and OE respectively, and PC5 for SOC.

**First:** draw the design and assign all the I/O port address.



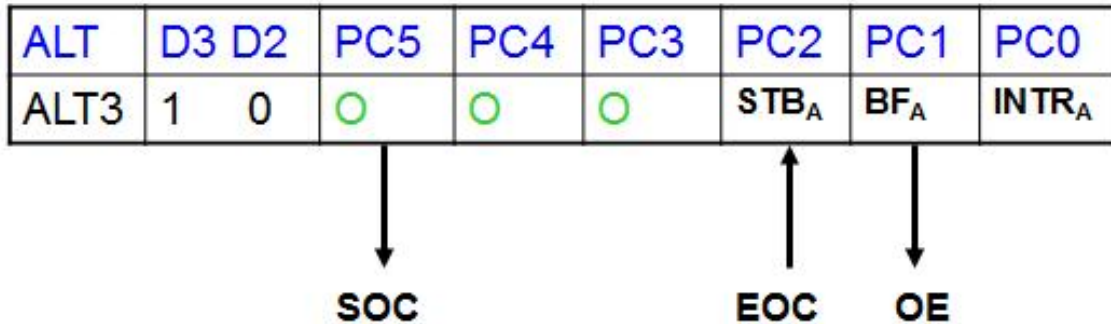
### Chip Selection

A7	A6	A5	A4	A3	A2	A1	A0	Port	
0	0	0	1	0	0	0	0	Control/Status Register	= 10H
0	0	0	1	0	0	1	0	Port A	= 11H
0	0	0	1	0	1	0	0	Port B	= 12H
0	0	0	1	0	1	1	0	Port C	= 13H
1	0	0	0	0	1	0	0	LSB Timer	= 14H
1	0	0	0	1	1	0	0	MSB Timer	= 15H

**Second:** Configure 8155 I/O ports:

Port A input with handshake (0), port C will work as ALT3 (1 0), port B output (1), no interrupt for port A and B (0 0), no timer effect (0 0).

D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	1	0	1	0



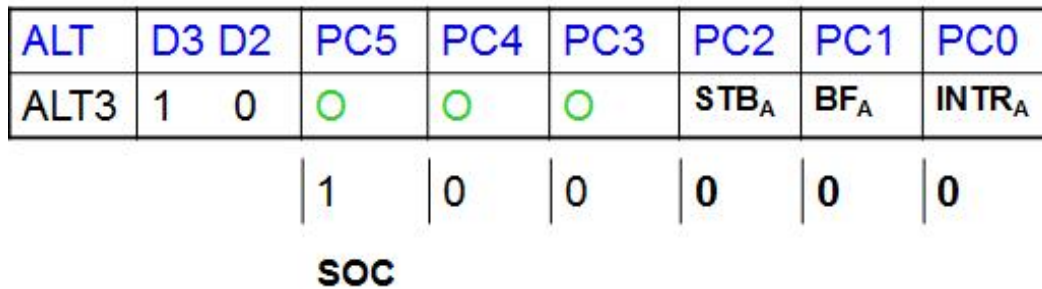
Data: Control word: 0AH

Port Address: Address of Control register: 10H

**Third:** 8155 sends SOC command to ADC

A small duration pulse on SOC input of ADC will start conversion process

SOC input of ADC is connected to port pin PC5 of Port C (Port address 13H)



Data: Data value 20H followed by 00H

Port Address: Address of port C: 13H

**PROG:**

MVI A, 0ah

Out 10h

Start: MVIA, 20h

Out 13h

MVI A, 00h

Out 13h

**Fourth:** 8155 communicates with ADC using Port C in handshake mode

- Port A used to input 8-bit data from ADC, Port C used for handshaking.
- End of conversion EOC; output pin; goes low when the conversion is over.  
ADC resets EOC to LOW at end of conversion.
- Output buffer enable OE this signal is used to read digital data from output buffer after end of conversion.  
8155 sets BF to 1 to enable ADC OE,  
8085 is waiting for BF to be SET to 1 and reads port A by making RD signal active (0), at the end of read cycle RD goes HIGH (1), this resets BF signal to 0.
- 8085 waits for BF signal to be RESET and starts conversion process again.
- To know the status of BF signal 8085 reads status register of 8155.
- Status register shares same address as control register.

D7	D6	D5	D4	D3	D2	D1	D0
X	Timer	INTEB	BFB	INTRB	INTEA	BFA	INTRA

### Status Word Definition

8085 reads status register

- Address of status register: 10H
- Reads port A if BFA = 1
- Output temperature on port B

Then, 8085 reads status register

- Address of status register: 10H
- Starts conversion again if BFA = 0

#### Cont. PROG:

Status: IN 10H

ANI 02H

JZ Status

IN 11H

OUT 12H

Again: IN 10H

ANI 02H

JNZ Again

JMP Start

**Ex 2:** Design (draw and explain) an interfacing circuit using the 8155 to display data to meet the following requirement:-

- Setup port A as O/P port to display data at seven segment LED.
- Setup port B as O/P port to display data at seven segment LED.
- Use a 3 to 8 decoder to assign I/O port address (O4).

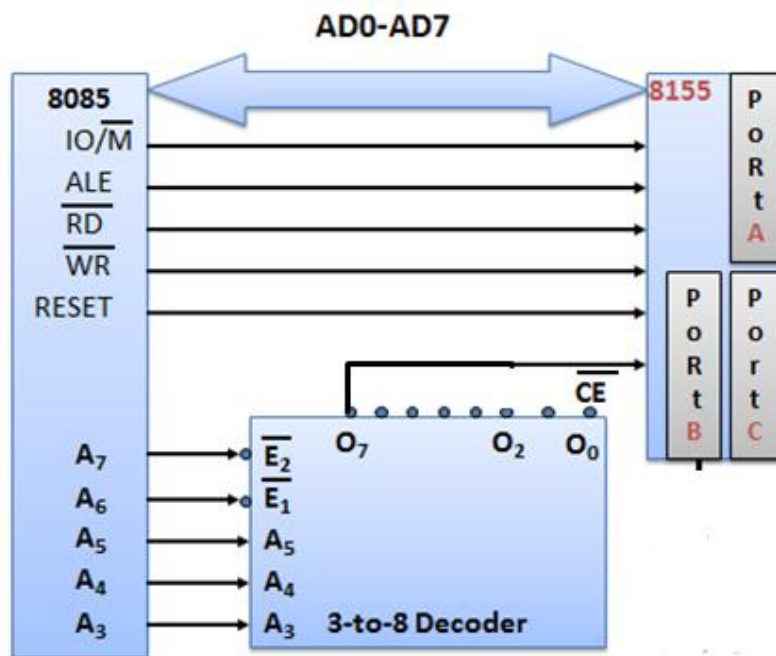
**Ex 3: Same Ex 1:** to meet the following requirement:-

- Use a 3 to 8 decoder to assign I/O port address (O4).
- Set up Port A in the handshake mode to read data from A/D Converter.
- Setup port B as output port to display data at seven segment LEDs.
- Use line PC3 from port C to initiate a conversion.
- Use the 8155 Timer to record conversation time.

**Ex 4:** in a programmable device, how does the processor differentiate between the control register and status register if both registers have the same port address?

**Ex 5:** show the control signal that enable the timer with count 3FF8 H in mode 3?

**Ex 6:** for the following Fig.



- Specify all assign I/O port address if the O7 of the decoder is connecting to CE.

- Assume that the decoder is eliminated and address line A7 is connect to CE through an inverter, specify the address of all ports assuming all other line don't care.
- Can any port be accessed with port address  $FD_H$ .

**Ex 7:** if the address  $F7_H$  is input to 3 to 8 decoder 8205, how can we make the decoder works, and what is the O/P of the decoder?

Summary:

- 1- Registers A/B in 8155 are vital to octal data interface as they can be configured as input or output.
- 2- mode ALT-4 in 8155 provides the hand-shake signals needed synch-based interface ccts.

Questions:

- 1- What is Alt-3 in 8155
- 2- Design a cct that uses Alt-1